

PROTOCOLS
Sea container
shipment of flowers

FloraLife

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SEA CONTAINER SHIPMENT OF FLOWERS

Purpose: The purpose of this document is to provide general guidelines and recommendations for shipping cut flowers by sea containers. The general recommendations may have to be modified or customized based on specific crops, packaging methods, and shipping/storage duration.

Notes: The protocol below assumes the following:

- The maximum duration from harvest to the end of shipment (where flowers are received and begin rehydration) is 3 weeks for roses, 4 weeks for alstroemeria and chrysanthemum, and 6 weeks for carnations.
- Fresh flowers (immediately after harvest) are used for the shipment.

General recommendations:

1. Variety selection

Not all commercial types and varieties of cut flowers are adaptable for shipping in sea containers or long-term storage. Depending on the genetics of the variety, some resist long-term storage better than others. If you are unsure about the storability of varieties, a preliminary selection test is recommended to determine potential varieties for shipping in sea containers. Flowers can be stored at 1.0°C for 3 weeks and then a vase life test with a batch of freshly harvested flowers (not stored) should be done. Varieties that are suitable for sea container shipment exhibit the following characteristics:

- Longer vase life potential
- Withstand temperature at 0.5 - 1.0°C
- Low susceptibility to Botrytis
- Low susceptibility to ethylene damage
- Good consistency and quality of leaves and stems. The quality of the leaves includes resistance to yellowing, darkening and dehydration.
- Low susceptibility to mechanical damage and bruising (petal texture)
- Rehydrate completely and quickly

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- Varieties with high stomatal density and resistance to stomatal dysfunction due to storage.

2. Facilities required at farm

- Cooler with minimal traffic, dedicated to the storage and handling of sea container shipped flowers with constant and / or backup generator. Able to maintain temperature down to 0.5°C. The coolers (walls, floors, drains and diffusers) should be cleaned and disinfected periodically to prevent contamination and reduce the spore load of bacteria and fungi.
- Proper closed transfer dock specifically designed for container loading.
- Pre-cooling facilities, well maintained and clean. The unit should be sanitized routinely with an effective sanitizer that provides a residual effect, e.g. (Floralife® Disinfectants)
- Routinely clean and sanitize (preferably using a Floralife® Disinfectant) all tools, buckets, coolers, carts and all surfaces that may come into contact with flowers.
- Have a dedicated and trained "container shipping team" to help focus on specific aspects of shipping sea containers.
- A water source and filtering facility to offer a consistent water quality.

3. Growing conditions of flowers

While it is not essential to adapt specific growing protocols for flowers for sea container shipment, it is important to adhere to appropriate cultural practices to obtain flowers that have good vigor, sufficient reserves and are free of diseases and pests.

Fertilization regime: N and Ca balance is important. Too much N and too little Ca can lead to poor storability and are not good for sea shipment. Ammonia-based nitrogen causes softer tissues than nitrate-based nitrogen fertilizers. Therefore, avoid too high levels of ammonia-based nitrogen for fertilizer.

Pest and disease management: Follow proper cultural practices to make sure the flowers are coming out of the field with minimal fungal spore load and insect pressure (e.g., Botrytis spores and thrips). Monitor the field routinely for insect and disease pressure.

Light and stomatal density: Flower stems containing leaves with active stomates perform better as they can rehydrate faster.

Reducing the humidity during the growing cycle.

Artificial light can inhibit proper stomate development and function

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4. **Harvesting**

Protocol of sanitization of all tools, buckets and pathways the flowers will come in contact with.

Age of the crop: Use flowers from an established crop, not new growth.

Harvest stage (maturity stage) of the bud:

Too immature flowers lead to poor flower opening; Too mature flowers lead to more mechanical damage and more Botrytis.

Crop-specific recommendations

- Alstroemeria – when 2 flowers are colored
- Carnation: early paintbrush stage
- Rose – Stage 2, a compromise between poor opening and mechanical damage.
- Handling of flowers after harvest.
- Move to the post-harvest area as soon as possible to reduce field heat.
- Minimize handling steps and mechanical damage
- Move flowers to a dedicated storage refrigerator.

Mixed bouquets: If mixed bouquets are being shipped, it is important to have a "timing protocol" for harvesting and hydration of individual flower types, and then bouquet making and rehydration of the final bouquet.

5. **Conditioning of flowers at farm for sea container shipment**

All containers and tools should be cleaned and disinfected periodically using Floralife® disinfectants.

Use clean water for post-harvest treatments (less than 500 CFU/ml bacteria count, residue-free, ideally less than 500 ppm TDS).

Use chilled water for hydration treatments. 34 F – 38 F (or 1 - 3 °C)

If chlorine is used for pretreatment water for hydration treatments, make sure that free chlorine levels are around 10 and 15 ppm.

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The following treatments are needed depending on the crop:

- Hydration treatment
- Anti-ethylene treatment
- Antibotrytis treatment
- Hormone treatment

Crop-specific recommendations

Roses: Floralife® Shield Ultra (1 ml to 1.5 ml/L) combined with Silwet Gold (compatible surfactant 0.5). Treat rose heads as a dip or spray.

For an uptake solution, use one of the following options depending on availability:

1. Floralife® Quick Dip, after hydrate with Floralife® Hydraflor Clear Ultra (1 ml/L)
2. Floralife® Hydrate Plus 100 (1.0 ml/L) and Floralife® Ethyl Guard ULTRA (0.5 ml/L)

Carnations: Floralife® EthylGuard ULTRA (1.5 ml/L) and Floralife® Hydrate Plus 100 (1.0 ml/L)

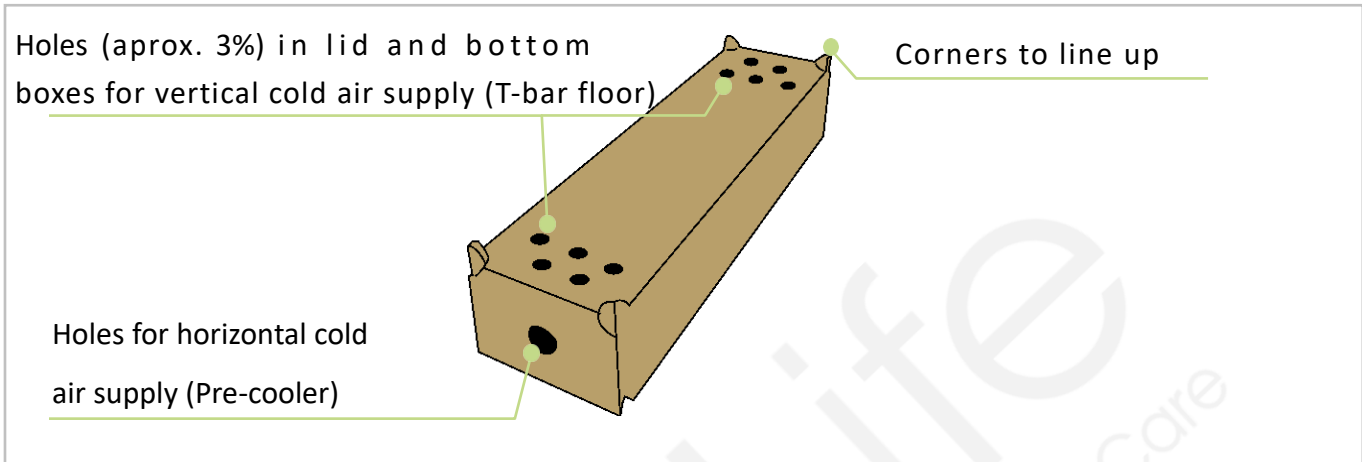
Alstroemeria: A mix of Floralife® Bulb 100 (0.3 ml/L), Floralife® EthylGuard ULTRA (0.5 ml/L) and Floralife® Hydrate Plus 100 (1.0 ml/L)

Chrysanthemum: Floralife® Express 100 (2ml/L)

6. Packaging

All flowers, boxes, sleeves, pallets and any other packing material should be cooled to 1°C before packaging.

Boxes: Specific boxes designed for sea container shipment should be used. These boxes have holes on all 4 sides for better air exchange.



Sleeves: Use vented sleeves if possible. This technology will allow for improved and uniform air exchange, humidity control and better temperature control within the box.

Bunching (number of stems per bunch, stem length): depends on the crop, avoid more than 25 flower stems per bunch.

Number of flowers (bunches) per box: No specific recommendations for optimum number of stems per box. The important factor is not to overpack and make sure there is enough space for air exchange and ensure that the flowers stay within the box space and do not overextend (belly boxes) to allow the flower to hold the weight of boxes stacked on top of them.

Product recommendations to be included in boxes

1. Roses and Alstroemeria and other crops with potential Botrytis issues: Floralife® Transport Paper and EthylBloc sachets.
2. Roses, alstroemeria, carnations and mixed bouquets with ethylene-sensitive flowers: EthylBloc sachets.

7. Transport of flowers from the farm to container loading.

Use properly closed transfer dock for unloading

Use time-sensitive loading protocols for a refrigerated truck at 1-2°C

Temperature and humidity management during transport: Temperature 1-2°C

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8. Palletizing boxes for sea containers loading.

Closed loading and unloading docks

Quick unloading and loading protocols, flowers should be at the same temperature as the sea container shipment

Palletizing: Use "COF" / Flower pallets shown below – designed for ocean freight flower shipment. These will allow proper and improved airflow during shipment.



9. Sea container parameters

- Container should be sanitized prior to loading. A Floralife® disinfectant-based cleaning is recommended after each journey.
- Container floor is "BLOCKED PROPERLY" in order to assure proper airflow.

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- Use of a GENTEC/pack to port in LAR inland transport to export port



- Container temperature ideal at 0.5 to 1 °C, with proper range depending on the crop.
- Align box vents all directions; corner stacked and pallet bound.

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- Box loading configuration optimized, Proper air movement
- Air exchange set at 20 m³/h.
- Drain holes closed
- Humidity control: OFF
- Defrost cycle and air circulation set to automatic/constant cycle
- Follow the temperature protocol in the boat loading procedure (keep the unit on until the boat connection is complete)

10. Receiving sea container shipped flowers after the journey.

- Closed unloading docks
- Quick unloading
- Have proper pre-cooler to remove a latent inspection head build up.

11. Rehydration of flowers and processing for next phase.

- Typically, flowers recover if the weight loss during the trip is less than 10%. Although flower may look wilted, they will rehydrate and will have an acceptable vase life if proper protocols are followed.
- Overnight gradual rehydration in cooler is recommended.
- Rehydration should be done in a sanitized cooler at 1 - 2 °C and 75% - 85% relative humidity.
- Use chilled water to make the solutions.
- Use FloraLife® Express Clear 200 or Express Clear 200 Ultra to rehydrate all flowers. It is recommended to re-cut the ends of the stem.
- Use buckets with proper support for all flower stems lengths to prevent bending during hydration.
- Do not overpack each bucket, as the flowers will absorb quite a bit of solution quickly and will need space to expand.
- It may be necessary to release pressure on the wrappers, if, for example, the roses are packed in sleeves. This will prevent flower to flower mechanical damage during hydration.